REMARKS

The Office Action dated October 19, 2004 has been reviewed carefully and the application has been amended in a sincere effort to place the claims in condition for allowance.

Objection to the Drawings

All of the items mentioned in paragraph 4 of the Office Action have been addressed and new drawings have been provided. Replacement Sheets for each sheet of the drawings are enclosed herewith for the approval of the Examiner.

Claim Objections

Claim 45 was objected to under 37 C.F.R. § 1.7 (c) as being of improper dependent form. Claim 45 has been amended to limit the structure of the direct oxidation fuel cell and water generating system with the recital as amended, that will read as follows: "wherein said ...fuel inlet port introduces fuel into the anode chamber of said housing, and said adjustable oxygen port introduces oxygen into the anode chamber of said housing such that said system functions to generate water, and said system is further coupled to a second fuel cell to deliver water to the anode of said second fuel cell." It is believed that this amendment places claim 45 in condition for allowance.

Claim Rejections – 35 U.S.C. § 112

Claims 21 through 45 and claims 48 through 54 were rejected under 35 U.S.C. § 112 first paragraph, as not complying with the written description requirement.

Briefly, Applicants may rely for disclosure upon the specification including the original claims and the drawings, as filed. MPEP § 608. Thus, both the specification and the drawings can be relied upon to satisfy the written description requirement. Further, there is no requirement that all elements of a particular claim be shown in the same drawing. In addition, Applicants note that support for each cited element of each rejected claim is set forth in these remarks, however, this is not limiting to the invention, as the scope of the claims is broader such that alternatives and equivalents are encompassed, in addition to the specific illustrative embodiments as depicted in the drawings.

Referring to claim 21, the Examiner states that the limitations in step D combined with the limitations of step F are not in the original disclosure. It is first noted that claim 21 covers a number of alternative embodiments of the invention that are illustrated in the figures. As amended, step D recites" "a water generating assembly in fluid communication with said fuel source, said source of oxygen, and said fuel cell...."

For example, in one embodiment of the invention, the water generating assembly of step D of claim 21 can be implemented as item 23 as shown in Fig. 2. This water generating assembly 23 is shown as being in fluid communication via conduit 29 with a fuel source 22. It is also in fluid communication with a source of oxygen as illustrated by the words "OXYGEN (AIR)" with the accompanying arrows depicted in the lower portion of Fig. 2, and the descriptions thereof. The fuel cell is item 24. As is readily apparent from the drawing, the water generating assembly 23 is in "fluid communication" (as recited in amended claim 21) with the fuel source (22), a source of oxygen ("OXYGEN(AIR)") and the fuel cell (24).

The second fuel cell in the illustrative embodiment is the electricity-producing fuel cell 24 (Fig. 2). The second fuel cell may be in the form of a direct oxidation fuel cell of any known type, one example of which is illustrated as item 3 as shown in Fig. 1. Item 13 of Fig. 3 is a load coupled across the fuel cell that can be coupled across the cell when the cell is to produce electricity, as recited in step F of claim 21.

As noted paragraph D of claim 21 is illustrated, in one embodiment, as item 23 in Fig. 2. There are also other figures related to alternate embodiments of the invention in which, for example, the water generating assembly is located within a different fuel cell system structure. The water generating assembly is illustrated, for example, as item 83 in Fig. 7, or item 103 in Fig. 8. Furthermore, the details of the various embodiments of the water generating assembly of the present invention are set forth in Figs. 3 – 6. This is expressly stated at page 9, lines 19 – 21, which states: "The detailed construction of various preferred embodiments of the water generator 23 may be understood with reference to Figs. 3 – 6." As noted by the Examiner, the direct oxidation fuel cell of Fig. 6 itself could be adapted to function as a water generating assembly 23, in one embodiment of the invention.

Accordingly, steps D, F and the remaining language of claim 21 are well supported by the original disclosure.

Turning to subparagraph E of claim 21, the Examiner further states that the limitation "a controller in communicating relationship with said water generating assembly

and said fuel cell that controls the introduction of fuel, oxygen and water, selectively into said water generating assembly to generate water" is not in the original disclosure. It is first noted that claim 21 has been amended to delete paragraph E, and this subject matter is covered in newly presented claim 55.

However, Applicants further note that the "controller" for example, is fully supported by the original disclosure in that the controller may be implemented as the conduit 29 and valve 20 of Fig. 2, or may be the combination of the inlets and outlets in Fig. 6, as adjusted to control the ingress and egress of fuel, oxygen, water and carbon dioxide, appropriately. In addition, the controller of new claim 55 can be the conduit 89 and valve 91 combination of Fig. 7. The controller may alternatively be the valve 109 and the conduits 108 in Fig. 8.

It is further noted that the controller is supported by the Summary of the Invention, which indicates (beginning at line 28): "In addition, because the chemical conversion to the water is relatively efficient, the concentration of the fuel can be easily controlled by controlling the amount of fuel that is oxidized for the purpose of generating water." This is further supported by the statement on page 9, lines 18 through 20 which states: "operation of the water generator 23 is controlled by the operation of valve 20, which manages the flow of fuel or a fuel solution into the water generator 23" and further at page 9, lines 25 through 28 indicate "said surface 231 may be disposed within a housing (not shown) which may, but need not, have valves or other components (not shown) that control the introduction of fuel and air as well as the distribution of catalytic regen-

erative water and carbon dioxide." Taken together, all of these passages in the specification, the drawings, and the originally filed claims support the recital of a "controller."

Based upon the foregoing, it is believed that amended independent claim 21 is now in condition for allowance.

Claim 22 has been amended to refer to a "controller" and this item is fully supported by the original disclosure as previously outlined herein.

Claim 23 was rejected based upon the limitation: "a valve, a valve assembly that includes means for controlling the opening and closing of one or more valves in the valve assembly," as not being in the original disclosure. It is noted that "the subject matter of the claim need not be described literally (i.e. using the same terms or *in haec verba*) in order for the disclosure to satisfy the written description requirement. MPEP § 2163.02. For example, the term "valve assembly" is supported by the references in the disclosure to the plural "valves" and/ or by the reference to at least one valve plus other components. Specifically, the term "valve assembly" is supported by the statement at page 9, lines 25 through 28, which states "Said surface 231 may be disposed within a housing (not shown) which may, but need not, have valves or other components (not shown) that control the introduction of fuel and air...." (Emphasis added) Thus, the singular "valve" (valve 20 of Fig. 2) as well as the plural "valves" (which may comprise a valve assembly) are both fully supported in the instant specification.

A number of structures are also suggested for the "means for controlling the opening and closing of one or more valves in the valve assembly." For example, beginning at

page 4, line 28 through page 5, line 4, the specification indicates that the water generator is disposed along "the flow path that connects the fuel source to the anode chamber" of the fuel cell. This is illustrated in a number of the drawings. The specification further states that pump, valve, or other passive means may be used to supply methanol to the water generator. (Specification, page 5, lines 2 – 3). Thus, the "valve," "valve assembly" and "the means for controlling the opening or closing of one or more valves in the valves in the valve assembly" are fully supported. In addition, those skilled in the art will readily recognize that there are many kinds of valves, such as a thermally actuated valve, pressure operated valves and electrically or mechanically operated valves that may be employed. Thus, the "means for opening and closing" such valves will depend upon the specific implementation used in a particular application of the invention, and this will be apparent to those skilled in the art.

All of the features of claim 23 are supported by the original disclosure.

Claims 26 – 28 have been cancelled.

Turning to claim 31, and with reference to Fig. 2, the "first fluid flow controller" is supported by item 20 and the first conduit is supported by item 29, and the water generating assembly is supported by item 23 and the description thereof. The "second fluid flow controller" is not separately shown but those skilled in the art will recognize that the fluid flow controller will be disposed along the second conduit (item 27) leading from the water generating assembly 23, to the direct oxidation fuel cell 24. One skilled in the art would further understand that the second fluid flow controller would possibly be a similar component to the first fluid flow controller. In one embodiment of the invention first

fluid flow controller 20 is identified as a valve. Pumps and other passive means as well as multiple valves are also contemplated, as well as gas permeable, fluid impermeable membranes and materials. Those skilled in the art will recognize that a variety of fluid flow controllers could be used in addition to or instead of the valves which are shown in the illustrative embodiments of the invention. Accordingly, it is respectfully submitted that claim 31 is fully supported by the original disclosure.

Similarly, claim 32 specifically recites that the first fluid flow controller, is a valve (item 20). The second fluid flow controller could also be a valve. Multiple valves, a pump, or other passive means or certain materials may also function as the "valve assembly" and the "means for controlling the opening and closing of said valve or one or more valves in the valve assembly," as discussed above.

Claim 34 recites that at least one fluid flow controller controls the introduction of fluids into or through one of said first, second and third conduits. As noted, an illustrative embodiment of the claimed invention (though not limited thereto) is illustrated in Fig. 2. The first fluid flow controller is the item 20, which may be a valve. The first conduit is conduit 29. The second conduit is conduit 27. The third conduit is conduit 30. Each of the components recited in claim 34 are supported by the original disclosure particularly with reference to Fig. 2.

Similarly, claim 35 is fully supported for the reasons set forth herein before with respect to a valve, a valve assembly and means for controlling the opening and closing of the same.

Claim 36 has been amended herein and is supported by the embodiment of Fig. 4.

Claim 37 has been amended to recite a plurality of adjustable openings as opposed to a controller. The plurality of openings are fully supported by Fig. 6 and the description thereof.

Claim 40 has been amended to recite that the oxygen port in the housing can be closed to prevent oxygen from entering "said anode chamber".

Claim 44 has been amended to recite a variable load which in one embodiment is item 68 in Fig. 6 and supported by the statements cited by the Examiner from page 12 lines 31 to page 13 line 1, of the specification which state: "it may be further possible to intentionally vary said load..." Those skilled in the art would understand a load (or resistance) can be varied in order to manipulate the operating characteristics of the water generator/fuel cell system.

Claim 48 has been amended to clarify that the step of reacting at least a portion of fuel with oxygen can be performed by the further step of using a water generating assembly to perform such step.

With respect to claim 51, paragraph E has been cancelled. With respect to the objection for paragraph F the recital "controlling the introduction of fuel and oxygen into said housing as needed to cause the system to function to either generate electricity or generate water" is supported by the combined statement: "Said water generator/DMFC 61 can be used to generate water by: 1) introducing excess fuel (in proportion to the demand of the attached load) to a DMFC of standard design and materials; or 2) introducing

fuel to a water generator/DMFC 61 without a load being connected...." (Specification page 12, lines 24 through 28). This passages supports the recital "controlling the introduction of fuel". The following passage supports the recital "controlling the introduction of... oxygen". More specifically, the specification states "oxygen is prevented from entering the anode chamber 66 and water is generating on the catalyzed cathode aspect of the PCM 63." (Specification, page 12, lines 20-22). As noted herein before, the subject matter of the claim need not be described literally. Controlling the introduction of oxygen into a housing includes "preventing" oxygen from entering the housing. It is respectfully submitted therefore that the claim recital is supported by the original disclosure.

Claims 21 – 45 and 48 – 54 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claim 21 was rejected based on the recital "communicating relationship." For consistency, the term "communicating relationship" has been changed herein to "fluid communication" throughout the claims.

In claim 23, the limitation objected to by the Examiner has been changed to indicate that the valve assembly includes one or more valves. Applicant has previously herein set forth the corresponding structure described in the specification for the means plus function language.

Claims 26, 27 and claim 28 have been cancelled.

Claims 32 and 35 have been amended in the same manner as has claim 23 and the same comments apply thereto.

As noted herein before claim 36 has been amended to conform to the illustrations.

With respect to the rejection of claim 38, the Examiner indicates that the limitation a "source of oxygen in fluid communication with said housing" is in definite because it is unclear which part of the housing the source of oxygen is in fluid communication with. Those skilled in the art will recognize that the oxygen source can be in fluid communication with any part of the housing that would allow the catalytic reaction to occur. By way of example, there are several embodiments in which oxygen can be introduced into the anode chamber such as in Fig. 6, depending upon the particular application of the invention.

Claim 44 has been amended herein to address the Examiner's rejections.

Claim 45 was amended to indicate that the water is delivered to the anode of a second fuel cell.

Claim 48 depends upon claim 1, which has been amended to provide proper antecedent bases.

The term "as needed" has been removed from claim 51. Either fuel or oxygen or varying amounts of either fuel and/or oxygen can be added or restricted from the housing to either generate electricity or generate water as described fully in the specification and the above quoted passages therefrom. Therefore, the term is redundant and has been removed. All of the objections and rejections of the claims pursuant to 35 U.S.C. § 112

have been addressed herein with the claim amendments and citations from the original disclosure set forth herein.

Claim Rejections 35 U.S.C. § 102

Claims 1 and 46-50 under 35 U.S.C. § 102(b) as being anticipated by United States Patent No. 5,773,162 to Surampudi et al. ("Surampudi"), as evidenced by United States Patent No. 5,795,668 to Banerjee ("Banerjee").

Briefly, Applicants' invention, as claimed in claim 1, is a method of generating water that can be used to adjust fuel concentration. This allows a fuel substance with a higher concentration of carbonaceous fuel than can be efficiently reacted at the anode of the fuel cell to be carried in the fuel cell system, resulting in a higher energy density for the overall fuel cell system. In accordance with the invention, water is intentionally generated when fuel is introduced to a catalyst in the presence of oxygen. Thus, the invention involves intentionally generating water in order to provide the water needed for the anode reaction, while allowing a higher concentration fuel to be carried to improve the energy density of the system, but doing so without either: a) requiring a separate water supply to deliver water to the anode, or b) without requiring re-circulating water from the cathode back to the anode, however, such cathode recirculation may be included in certain applications of the invention as part an overall water management strategy. Each of those prior techniques has parasitic losses associated with the additional components required to deliver and/or re-circulate the water.

Moreover, Applicants' invention of claim 1 provides a solution in which water can be generated on a catalyst that is in the *anode* chamber or in another chamber or assembly, as opposed to the cathode chamber, and can use fuel that does not pass through the catalyzed membrane electrolyte. This corresponds with Applicants' technique,

where water is intentionally generated using fuel reacted on a catalyst which fuel does not pass through the protonically conductive, electronically non-conductive membrane. To enhance and clarify claim 1, it has been amended to recite that at least a portion of the fuel is reacted "to produce water" to emphasize the fact that the fuel is intentionally reacted on the catalyst to produce water. The catalyst can be the anode catalyst, or a catalyst that is present in another chamber of the fuel cell system, or even within a conduit in the fuel cell system. In other embodiments, as claimed in dependent claims 48-50, a first fuel cell is used to generate water to be provided to a second fuel cell for the generation of electricity.

In contrast, Surampudi describes a typical direct methanol fuel cell system that is used to generate electricity. Surampudi does not describe intentionally generating water by reacting fuel on a catalyst in the presence of oxygen to produce water. Surampudi does not teach that this water can be generated on the anode side of the fuel cell, nor does Suramapudi disclose an assembly whose function is to generate water via a catalytic reaction.

In fact, Surampudi discusses the disadvantages of fuel cross over and states: "Fuel crossover lowers the operating potential of the oxygen electrode and results in consumption of fuel without producing useful electrical energy. In general, fuel crossover is a parasitic reaction which lowers efficiency, reduces performance and generates heat in the fuel cell. It is therefore desirable to minimize the rate of fuel crossover." (Surampudi, Col. 5, lines 26 – 30). Nowhere does Surampudi teach that water can be generated in a separate reaction on the anode aspect of the fuel cell.

Claims 46-50 depend upon claim 1 and provide even further limitations that are not taught by Surampudi, such as controlling the amount of fuel (claim 46) or controlling the amount of oxygen (claim 47) or providing the water generating assembly in a direct oxidation fuel cell system (claim 48, 49). None of these items are taught or suggested by Surampudi. Thus, Surampudi cannot be said to have anticipated claim 1 and the claims dependent therefrom.

The claims are not anticipated by Surampudi even as evidenced by Banerjee. Banerjee describes a fuel cell having a reinforced membrane that reduces methanol crossover. As noted, teachings about the disadvantages of methanol cross over, and Banerjee's solution of reinforcing the membrane to avoid that phenomenon, do not suggest intentionally generating water and using that water to adjust fuel concentration. Applicants' fuel cell system could easily use both the techniques of the present invention for water generation and the Banerjee reinforced membrane (under an appropriate arrangement) for reduction of fuel crossover because these two solutions are independent of one another.

Accordingly, in view of the amendments and arguments presented herein, claim 1 and 46-50 are not anticipated by Surampudi as evidenced by Banerjee.

Claim Rejections – 35 U.S.C. § 102(e)

Claims 1, 21-35, 37-40 and 45-51 were rejected under 35 U.S.C. § 102(e) as anticipated by Acker et al., U.S. Publication No. 2002/0122966 A1, which has now issued as United States Patent No. 6,821,658.

The Acker patent does not anticipate the present invention because Acker, briefly, is directed, in part, to inducing methanol cross over or reacting fuel in dedicated plenums in order to generate heat to increase the temperature of the fuel cell or fuel cell system. Simply put, Acker is not providing fuel to a catalyst in the presence of oxygen in order to generate water. In fact, Acker does not contain teachings about water generation. Furthermore, Applicants method and apparatus do not suggest methanol crossover through a protonically conductive membrane as a means to deliver fuel to a catalytic site, as is specifically contemplated in Acker. The fuel in Applicants' technique does not have to cross over the protonically conductive membrane at all, but simply reacts on a catalyst in the anode chamber or in another assembly to produce water. The features of Applicants' invention are not disclosed, taught or anticipated by Acker.

Claims 1, 21-35, 37-40 and 45-51 were rejected under 35 U.S.C. § 102(e) as being anticipated by United States Publication No. 2003/0003336 A1 to Colbow et al., ("Colbow").

Colbow relates to regulating the temperature of a fuel cell by inducing methanol crossover to thereby produce combustion. (Paragraph 0020). As stated above with respect to Acker, Applicant's invention is not directed to adjusting or raising the temperature of the fuel cell. Nor does Applicants' method and apparatus rely on methanol cross over as a fuel transport mechanism. Applicants' invention generates water for use in the fuel cell system by reacting fuel on a catalyst by applying the fuel directly to a catalyst, whether in the anode chamber of the fuel cell, or within a separate assembly. Colbow does not anticipate Applicants' claims.

SUMMARY

All of the claims have been amended herein, either directly, or through dependency. All of the Examiner's objections and rejections have been addressed herein. Based upon the amendments and arguments presented in this response, it is respectfully submitted that the application is now in condition for allowance.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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